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A review of the *sarawakensis* species group of the ground beetle genus *Orthogonius* MacLeay, 1825 (Coleoptera, Carabidae, Orthogoniini)

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Abstract

The *sarawakensis* species group of the termitophilous carabid genus *Orthogonius* MacLeay, 1825 is defined and reviewed. Members of this species group are distributed in Southeast Asia and represented by four species, including two new species: *Orthogonius sabahicus* **sp. n.** (Sabah, northern Borneo, Malaysia) and *Orthogonius morvanianus* **sp. n.** (southern Thailand). A key to all species of the species group is also provided.

Keywords

Ground beetle, termitophilous, taxonomy, new species, Southeast Asia

Introduction

As part of the series works on the dominant genus *Orthogonius* MacLeay, 1825 in the tribe Orthogoniini, the *lancangjiang* and *baconii* species groups have been reviewed respectively (Tian and Deuve 2013, 2016). In this paper, the *sarawakensis* species group is dealt with.

The members of the *sarawakensis* species group are medium to large sized, broad and brown ground beetles having large and prominent eyes, rounded off pronotal

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hind angles, flat intervals, and median and posterior setiferous pores in the 3rd elytral interval located on median portion of the interval, instead of close to the 2nd stria as in other *Orthogonius* species.

All of the four species of this group are distributed in Southeast Asia. The first species of this group is *O. sarawakensis* Tian & Deuve, 2006 recorded from Sarawak, northern Borneo, eastern Malaysia. Then, the second species *O. perakicus* Tian & Deuve, 2007 was described from Perak, western Malaysia. In the present paper, further two new species are discovered from Sabah, northern Borneo, Malaysia and from Khao Sok NP, southern Thailand respectively, and hereinafter described.

Material and methods

All specimens for this study are dry and mounted material. Dissection and observation of the specimens were made using a WILD M32 binocular microscope. Detailed descriptions are provided for the new species, while only diagnostic character states are given for the known species. Habitus and male genital illustrations for all species are also presented. Digital photographs were taken and processed as in Tian and Deuve (2013).

Body length was measured from apex of right mandibles to apex of elytra; body width = width of elytra.

Abbreviations of measurements used in the text are as followings:

HL head length (from apex of right mandible to base of vertex);
HW head width (maximum distance across head, including eyes);
PL length of pronotum (measured from front to basal margins, through midline);
PW width of pronotum (greatest width of pronotum);
EL length of elytra (measured from base to apex of elytra, through suture);
EW width of elytra (greatest transverse distance across both elytra).

The depository abbreviations used in the text are as following:

CIB Collection of Dr. Ingo Brunk, Dresden, Germany;
CPM Collection of Mr. Pierre Morvan (Carentoir, France);
MNHN Muséum national d'Histoire naturelle, Paris, France;
SCAU South China Agricultural University, Guangzhou, China.

Taxonomy

Characteristics of the *sarawakensis* species group

Large-sized and robust; body brown or yellowish brown, moderately convex; glabrous, impunctate on head and pronotum; head wide, eyes moderate large and prominent;

mentum bisetose in most species (except for *O. sabahicus* sp. n. in which the mentum is asetose); apical margin of elytra broadly rounded, not truncate, and so without outer angles, inner angles broad in most species (but acute in *O. sarawakensis*); hind angles of pronotum widely rounded off, lateral expanded margins well-marked, subequal in width in middle, from flat (*O. sarawakensis*) to evidently reflexed throughout (*O. morvanianus* sp. n.); elytra convex, base well-bordered, striae moderately deep, intervals almost flat; 7th interval simple, not carinated; at least median and posterior setiferous pores of the 3rd interval located on median portion, instead of closing to the 2nd stria as in most *Orthogonius* species, anterior pores present (but absent in *O. sabahicus* sp. n.); the 2nd–7th intervals subequal wide in middle; protarsi more developed than meso- and metatarsi; middle tibiae not expanded in male; middle coxae asetose medially; apical spurs of hind tibiae long and sharp; hind femora moderately dilated, with two setae posteriorly; the 1st and 3rd hind tarsomeres longer than the 2nd and 4th respectively, the 4th tarsomere deeply and asymmetrically emarginated, outer lobe longer than the inner; all tarsal claws pectinate; prosternal process well-bordered at apex (but unbordered in *O. sarawakensis*); male genitalia robust, notably expanded in median portion, deeply arcuate ventrally, and then gradually narrowed towards apex which is more or less pointed, or suddenly contracted at tip, dorsal opening long and large; the apical lamella long or short, broadly blunt at apex.

Sexual dimorphism. In male, the 1st–3rd protarsomeres with two rows of spongy setae ventrally (Fig. 1A); ventrite VII slightly and shallowly emarginated at apical margin (Fig. 1B).

Distribution. Southeast Asia.

Key to species of the *sarawakensis* species group

1 Median and posterior setiferous pores of the 3rd elytral interval located on median portion, never close to the 2nd elytra stria..... **2**

– Median and posterior setiferous pores of the 3rd elytral interval close to the 2nd elytra stria..... **other *Orthogonius* groups**

2 Mentum asetose, the 3rd elytral interval with only median and posterior setiferous pores, anterior one wanted..... ***O. sabahicus* sp. n.**

– Mentum bisetose, the 3rd elytral interval with three setiferous pores..... **3**

3 Prosterna process unbordered at apex, inner angle of elytra sharp ..... ***O. sarawakensis* Tian & Deuve, 2006**

– Prosternal process well-bordered at apex, inner angle of elytra blunt..... **4**

4 Labrum slightly emarginated at frontal margin, the 4th hind tarsomere with a deeper emargination, outer lobe half as long as the joint..... ***O. perakicus* Tian & Deuve, 2007**

– Labrum strongly emarginated at frontal margin, 4th hind tarsomere with a shallower emargination, outer lobe shallower, about 1/3 as long as the joint... ***O. morvanianus* sp. n.**

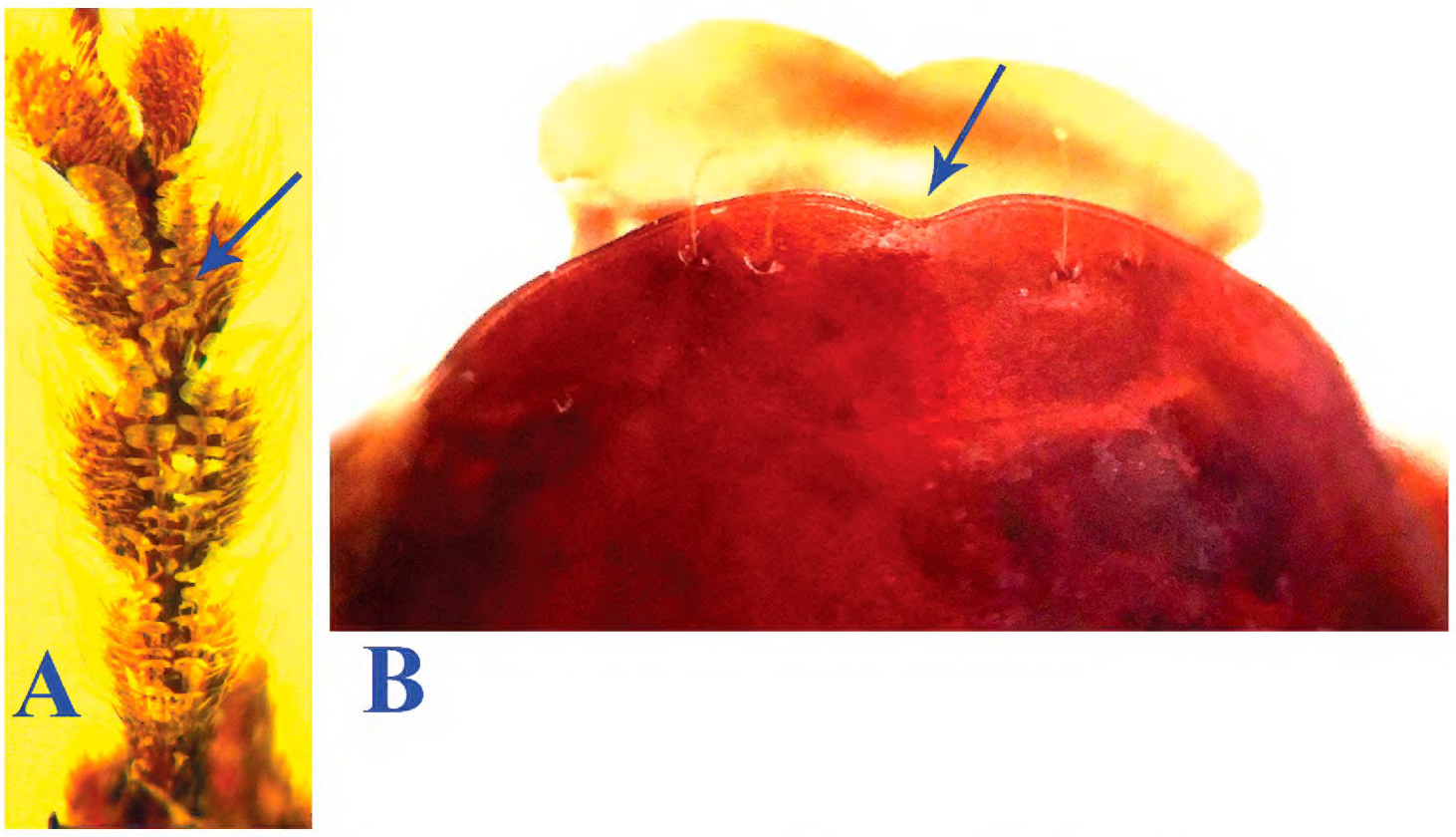

Figure 1. Protarsi and abdominal ventrite VII in male of *Orthogonius* **A** protarsi of *Orthogonius morvanianus* sp. n. **B** abdominal ventrite VII of *O. sarawakensis*.

Orthogonius sarawakensis Tian & Deuve, 2006

Figs 1B, 2A–C

Orthogonius sarawakensis Tian & Deuve, 2006: Tian and Deuve 2006: 133.

Type material. Length: 15.0 mm; width: 7.0 mm. Habitus as in Fig. 2A.

Diagnosis. Head dark brown, other parts of the body yellowish brown; head stout, as long as wide; labrum slightly emarginated at frontal margin; clypeus even near base, with two longitudinal furrows along both side, joining to frontal impressions respectively; mentum bisetose; pronotum transverse, PW/PL = 1.55, widest at about middle, strongly convex; lateral expanded margins almost flat, equal wide throughout; elytra elongate ovate, EL/LW = 1.54; base well-bordered; the 3rd interval with three setiferous pores, all are located on the interval; tarsal claws pectinate; prosternal process unbordered at apex, abdominal ventrite VII shallowly emarginated at apical margin in male.

Male genitalia (Fig. 2B, C): Short and robust, expanded in median portion; in dorsal view, apical lobe elongated, gradually narrowed towards apex, with apical lamella evidently longer than wide.

Female: Unknown.

Remarks. Easily separated from its congeners, *O. perakicus* Tian & Deuve, 2007 and *O. morvanianus* sp. n., by its unbordered prosternal process at apex, pointed elytral apex, and more elongated apical lobe of aedeagus.

Material examined. 1 male, the holotype, "Nord Borneo, Mont Kina Balu, 5-8, 1903, John Waterstradt", in MNHN; 1 male, same data as in holotype, in SCAU.

Distribution. Malaysia (Sarawak).

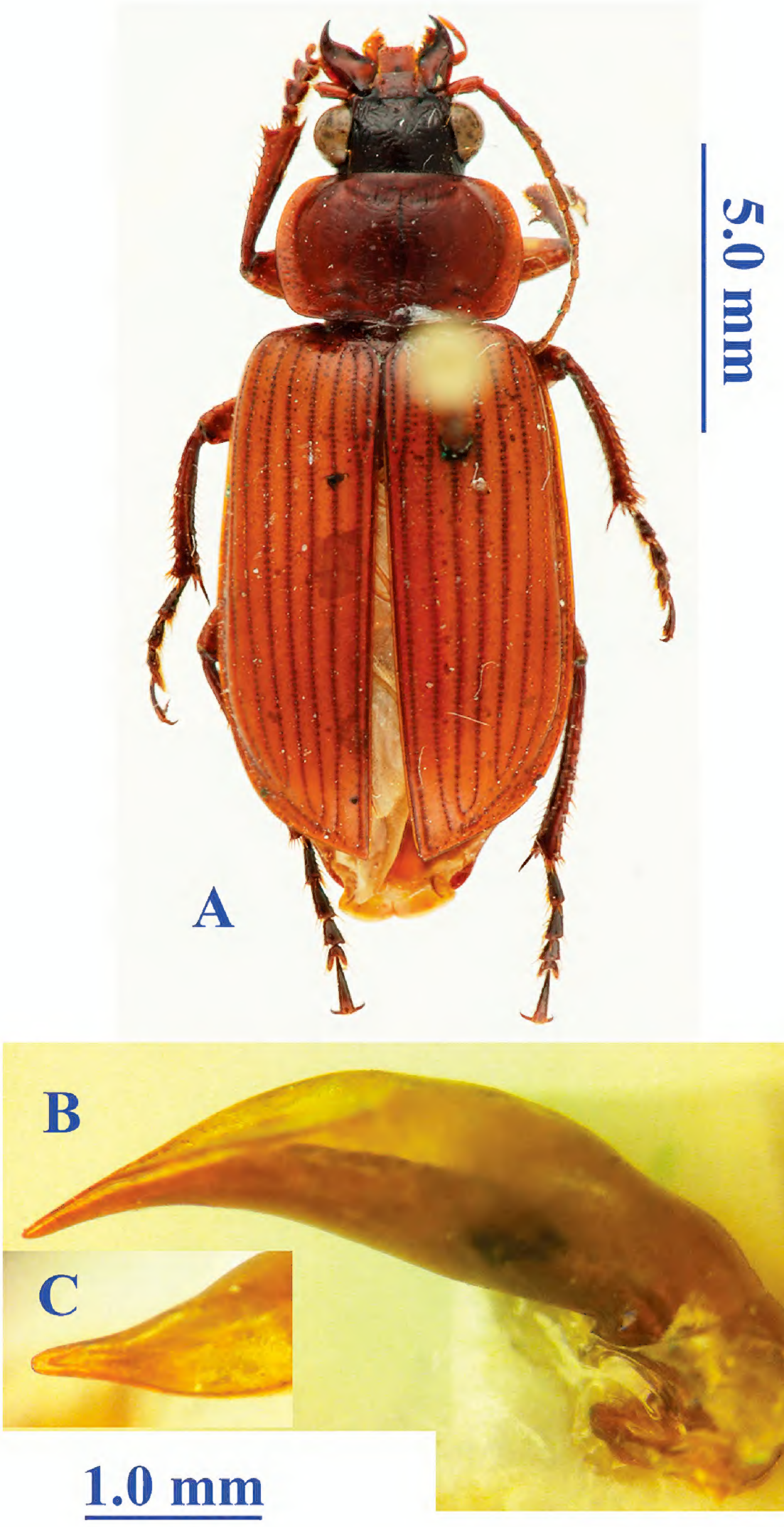

Figure 2. *Orthogonius sarawakensis* Tian & Deuve, 2006 **A** habitus, male, holotype **B** median lobe, right lateral view **C** apical lamella, dorsal view.

Orthogonius perakicus Tian & Deuve, 2007

Fig. 3

Orthogonius perakicus Tian & Deuve, 2007: Tian and Deuve 2007: 239.

Type material. Length: 14.0 mm; width: 5.5 mm. Habitus as in Fig. 3A.

Diagnosis. Elytra and sides of pronotum yellowish brown, head dark brown, pronotum light dark brown on disc; head as long as wide, clypeus smooth, front margin of labrum slightly emarginated; mentum bisetose; pronotum strongly transverse, PW/PL = 1.62; lateral expanded margins narrow and reflexed throughout, evenly widened; elytra well-bordered at base, elongate ovate, EL/EW = 1.58; apex broadly truncate, without outer angles, inner angles broadly obtuse; intervals flat; the 3rd interval with three setiferous pores, all on median portion of the interval; legs moderately developed; the 4th hind tarsomere emarginated as deep as 1/3 of the joint; all tarsal claws pectinate; prosternal process well-bordered at apex; abdominal ventrite VII in male slightly emarginated at apical margin.

Male genitalia (Fig. 3B, C): Median lobe of aedeagus stout, more or less bent near apex, apex pointed in profile, but obtuse in dorsal aspect, apical lamella longer than wide.

Remarks. Allied to *O. morvanianus* sp. n. Differs from the latter by its labrum shallowly emarginated at front, the 4th hind tarsomere having a deeper emargination, and apical lamella of aedeagus blunt at apex (see below for detail).

Material examined. 1 male, the holotype, "Perak", in the Collection of Bates, MNHN.

Distribution. Malaysia (Perak).

Orthogonius morvanianus sp. n.

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Figs 1A, 4A–C

Holotype. Male, "Thailand South, near Khao Sok NP, 3-6. II. 1997, A. Kudrna lgt", in CPM.

Length: 14.0 mm; width: 5.5 mm. Habitus as in Fig. 4A.

Description. Yellowish brown, with head dark brown, the 2nd–11th antennomeres, disc of pronotum, tibiae and tarsi of legs brown; surface glabrous, impuctate, head and pronotum finely striate, the 3rd, 5th and 7th elytral intervals each with a few tiny sparse punctures; surface moderately shiny; microsculptural engraved meshes densely isodiametric on the surface of head, pronotum and elytra; body rather flat.

Head stout, as long as wide; eyes very large and prominent; frons flat, vertex slightly convex, smooth; frontal impressions very small, foveate; clypeus bisetose, rather smooth near base; labrum 6-setose, evidently emarginate at apical margin; ligula very small and narrow, bisetose at apex; palps slender or elongate, subcylindrical, normally setose; palpiger asetose, mentum edentate, mentum and submentum each with one

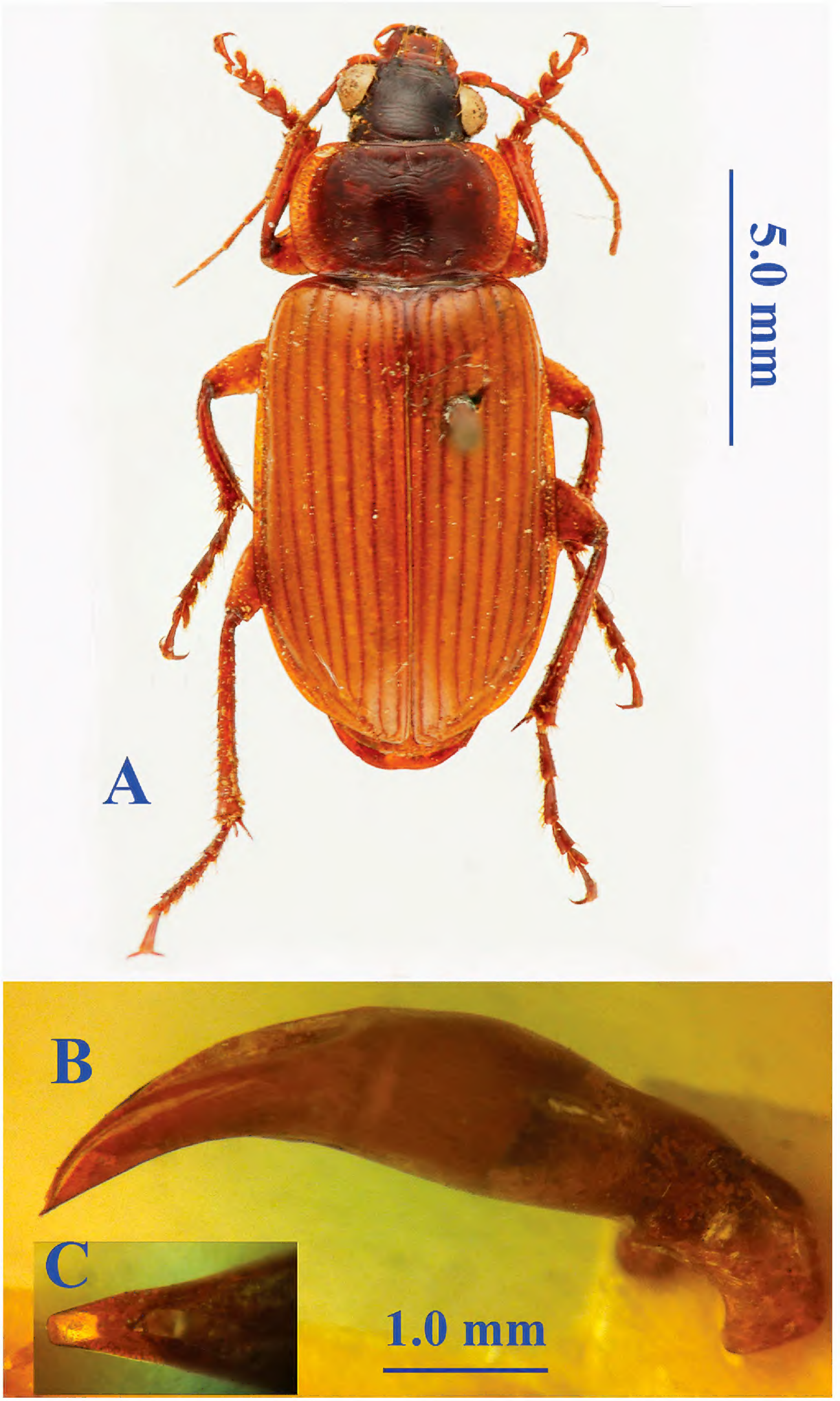

Figure 3. *Orthogonius perakicus* Tian & Deuve, 2007 **A** habitus, male, holotype **B** median lobe, right lateral view **C** apical lamella, dorsal view.

pair of setae, mental ones much shorter; antennae slender and long, reaching 1/4 of elytra from base, pubescent from apical 2/3 of the 4th antennomere; the 3rd antennomere as long as the 4th, both shorter than the 1st; the 1st–3rd antennomeres glabrous; evidently expanded laterally in the 4th and 5th antennomere; the 1st antennomere 1.6 times as long as the 2nd.

Pronotum strongly transverse, PW/PL = 1.78, sides evenly rounded, widest at about middle; both basal and fore margins beaded; lateral expanded margins well defined, subequal wide throughout, strongly reflexed, smooth though with punctate-like structures; both fore and hind angles rounded off; disc moderately convex, fore transversal impression evident, while hind one well-marked, joining basal foveae and the lateral expanded margins.

Elytra elongate ovate, much longer than wide, EL/EW = 1.63, moderately convex, apex broadly truncate, without outer apical angle, inner apical angle broadly obtuse; basal borders well-bordered; sides more or less paralleled in middle portion; striae quite deep; intervals nearly flat, subequal in width; the 3rd interval with three setiferous pores, anterior one close to the 3rd stria, while other two, median and posterior ones, on median portion of the interval; the 7th interval not carinated and without setae throughout.

Legs moderately developed; hind femur long and elongate, with 2 setae posteriorly; middle and hind coxae smooth and glabrous; fore tibia deeply sinuate at apical margin, outer angle sharp, outer margin distinctly serrate; middle tibia slender, not dilated medially in male; hind tibia slender, apex slightly dilated, apical spurs very long and sharp, the 1st tarsomere slightly longer than the 2nd, the 3rd tarsomere about 1.2 times longer than the 4th which is bilobed at apex, with outer lobe slightly shorter than half as long as the joint, outer lobe evidently longer than the inner; all tarsal claws moderately pectinate.

Male genitalia (Fig. 4B, C): Robust, expanded in median portion, then deeply concave on ventral margin, apex suddenly contracted, sharp, dorsal opening long and large, apex more or less pointed, with a fine tooth at subapex; in dorsal view the apical lamella quite long, slightly longer than wide, roundly obtuse at apex.

Prosternal process bordered at apex; apical margin of abdominal ventrite VII feebly emarginated in male.

Female: Unknown.

Remarks. Close to *O. perakicus* Tian & Deuve, 2007, but labrum strongly emarginated at frontal margin (slightly emarginated in *O. perakicus*), the 4th hind tarsomere deeply emarginated, but with outer lobe about 1/3 as long as the joint (half as long as the joint in *O. perakicus*).

Etymology. To be dedicated to Mr. Pierre Morvan (Carentoir, France), a good expert of Carabidae.

Distribution. Southern Thailand.

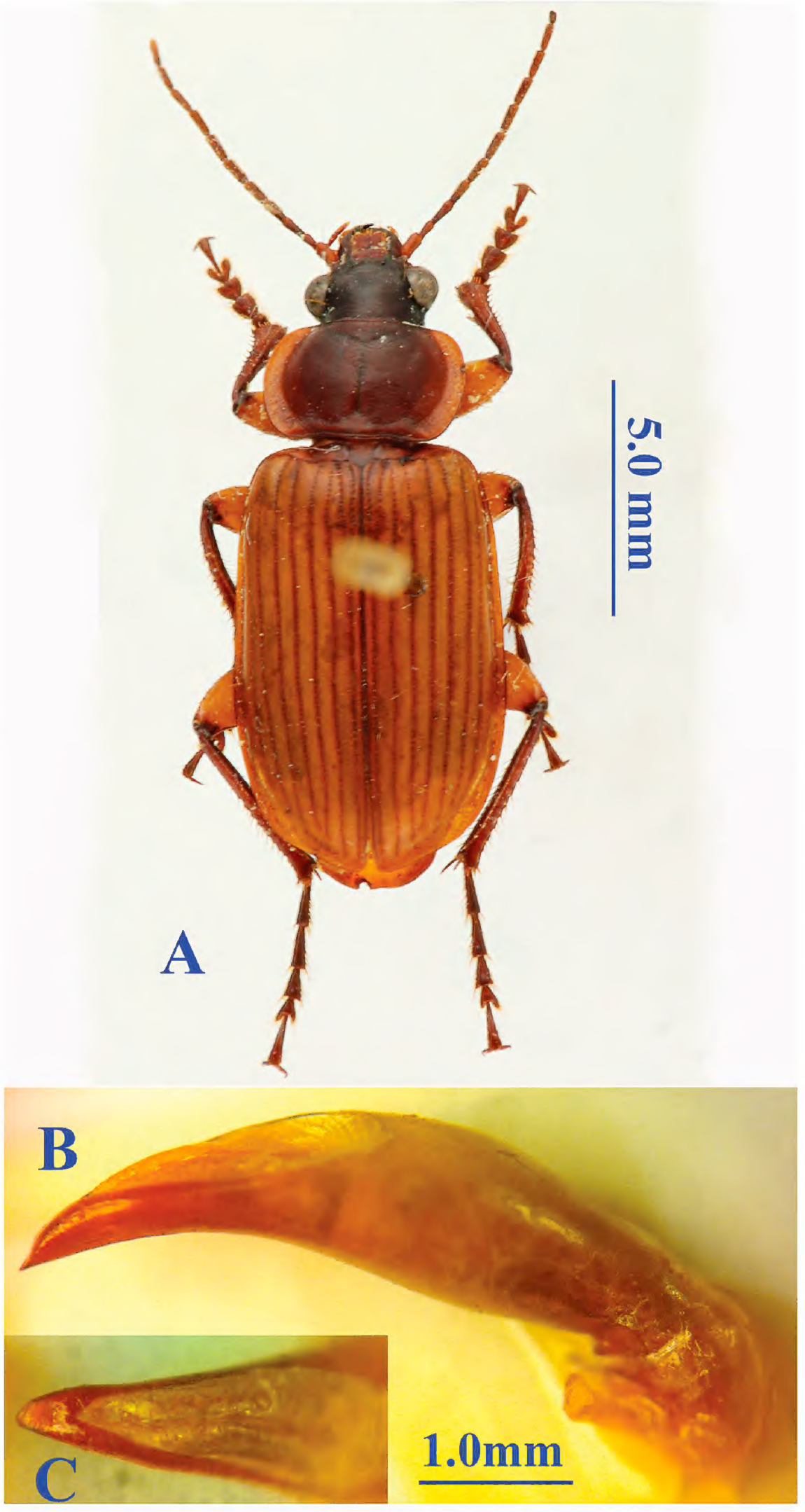

Figure 4. *Orthogonius morvanianus* sp. n. **A** habitus, male, holotype **B** median lobe, right lateral view **C** apical lamella, dorsal view.

***Orthogonius sabahicus* sp. n.**
http://zoobank.org/C8EA2EDC-08D7-42E2-962E-347D379DCF29
Fig. 5

Holotype. male, "Malaisie, Sabah, Crocker Range, Avril 94, Chew", in MNHN; paratypes: 1 male, "Malaysia, N. Borneo, Sabah, Keningau distr. Trus Madi Mt. 1150 m, 7.VII.2011, A. Klimenko legit", in CIB; 1 female, IBID, in SCAU.

Length: 16.0–17.0 mm; width: 6.5–6.6 mm. Habitus as in Fig. 5A.

Description. Head dark brown, other parts reddish brown; smooth and glabrous, impunctate, elytral intervals covered with fine and sparse punctures; head and pronotum faintly wrinkled; microsculptural engraved meshes isodiametric on head, pronotum and elytra.

Head stout, slightly longer than wide, HL/HW = 1.05–1.10; vertex convex; labrum quite long, nearly as long as wide, widely and feebly emarginated at frontal margin, 6-setose; clypeus bisetose, base raised and sides longitudinal furrowed, joining to the frontal impressions; frontal impressions pit-like; eyes moderately developed and prominent; palps slender, subcylindrical, the 3rd maxillary palpomere as long as the 4th, both glabrous, with two short setae at apex of the 3rd; the 2nd labial palpomere slightly longer than the 3rd, bisetose on inner margin, the 3rd faintly and sparsely setose; ligula narrow, bisetose at apex; mentum and palpigers unsetose, submentum bisetose; antennae extending beyond basal 1/5 of elytra, pubescent from the 4th antennomere, starting from basal 1/4; the 1st–3rd antennomeres and basal 1/4 of the 4th antennomere glabrous; the 1st antennomere stouter than other, with a long seta at subapex, several shorter setae present at apexes of each joint from the 2nd antennomere; the 1st antennomere less than twice as long as the 2nd, and slightly longer than the 3rd.

Pronotum transverse, notably wider than long, PW/PL = 1.66–1.68, widest at about middle; lateral expanded margins flat, even, feebly reflexed throughout; front and base well bordered; fore transversal impression faint, basal one evident; basal foveae small; disc markedly convex; front margin nearly straight at middle, basal margin feebly bisinuate; hind and front angles completely rounded off; base slightly shorter than front.

Elytra elongate-ovate, distinctly longer than wide, EL/EW = 1.61–1.63; nearly parallel-sided, widest at middle; basal border interrupted against the 1st–3rd intervals; humeri rather square; apex roundly truncate, without outer angles, inner angle broadly blunt; disc convex; striae finely and deeply striate; intervals convex, subequal in width; the 3rd interval with median and posterior setiferous pores (anterior one wanted), both are located on middle of the interval.

Femora moderately expanded, hind femur bisetose posteriorly; for tibia dilated at apex, apical margin obtusely truncate or sinuate towards outer angle, outer margin notably serrate; middle tibia slightly curved; hind legs slender, apical spurs long and sharp, the 1st and 3rd tarsomeres much longer than the 2nd and 4th respectively, the 4th tarsomere deeply emarginated at apex, with lobes about half as long as the joint; fore and middle tarsal claws weakly pectinate, hind claws simple.

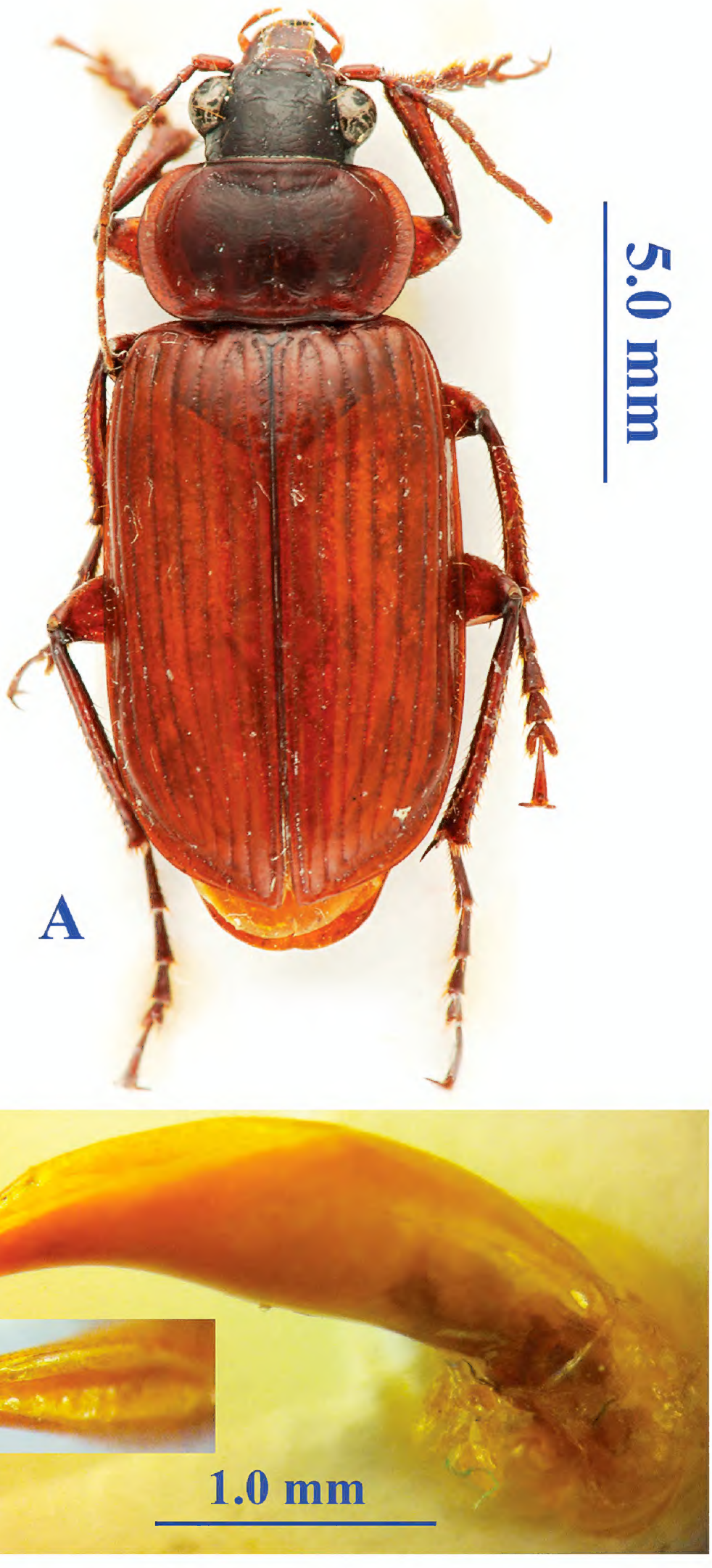

Figure 5. *Orthogonius sabahicus* sp. n. **A** habitus, male, holotype **B** median lobe, right lateral view **C** apical lamella, dorsal view.

Prosternal process bordered at apex; abdominal ventrite VII finely and shallowly emarginate at apical margin in male.

Male genitalia (Fig. 5B, C): Stout and robust, apex suddenly narrowed and pointed in lateral view; the apical lamella short, wider than long.

Remarks. It is a very peculiar species, differing from other congeners by its mentum asetose, elytral base incompletely bordered, anterior dorsal pores missed on the 3rd interval, and hind tarsal claws simple.

Etymology. To refer to the type locality.

Distribution. Malaysia (Sabah).

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